SECTION 1 - INTRODUCTION

1.1 GENERAL. The HFO 4 Light Table (Figure 1-1) is designed and manufactured by The Richards Corporation as a highly vibration-free work station for use by the professional photointerpreter. It is specifically suited to applications which require that film be viewed using high-magnification stereo microscopes such as the B&L Zoom 500 or Zoom 240.

1.2 DESCRIPTION. The table includes two light sources — high-intensity spotlights for viewing film through the scope and background lamps for previewing the film; a glass viewing stage which includes a mechanical drive mechanism to position the film under the fully adjustable optics focusing carriage (vertical carriage); a motorized film transport system capable of transporting two strands of film; and, a motorized elevation system which raises or lowers the table's work surface to afford the operator a comfortable work environment.

An overview of the various systems included in the HFO 4 Light Table follows. Refer to the section of the maintenance manual dealing directly with a subsystem for specific coverage.

Film Transport System	Section 4
Viewing Stage, Table Frame, and Vertical Carriage	Section 5
Light Sources	Section 6

1.2.1 Frame Assembly. Key to the light table's ability to provide the operator with a highly vibration-free view of the image is the HFO 4's frame. It consists of a caster-mounted support base, which includes the motorized elevation system, and an upper set of castings which provide mounting of the viewing stage and optical instrument's vertical carriage. Shock mounts, located between the support base and viewing stage casting, further reduce vibration.

1.2.1.1 Support Base. The support base is comprised of two castings and three adjustable legs. The lower casting is mounted on four rubber-tired casters. The casters allow easy movement of the light table from one location to another. The front casters are equipped with locking devices which, when engaged, prevent rotation and thus prevent the light table from moving.

The upper member of the support base, also a casting, is attached to the lower casting by three adjustable legs. The cylindrical legs house a chain-driven ball screw mechanism which transfers the motion of the elevation motor to affect changes in the height of the frame.

The two-pieced support base design provides viewing surface height adjustability without compromising rigidity. It allows the table to be easily set up for a viewing surface and eyepoint height that best suits its particular operator's size, reach, or preference.

1.2.1.2 Upper Frame. The upper frame, secured to the support base by four shock mounts, is a casting which provides a means of attaching the viewing stage and vertical carriage mount to the support base.

1.2.1.3 Vertical Carriage Mount. The vertical carriage mount is rigidly bolted to the upper frame casting. The mount is made from two castings which slide together on bearing rails. The two-piece design allows the operator to move the optics back, thus providing a clear view of the film when optics are not desired. A spring-loaded positioning knob drops into a detent position to establish the proper viewing location for the slide. In addition, a separate locking pin is provided to lock the slide for table shipment.

1.2.2 Viewing Stage. The HFO 4 Light Table's fixed optics mount is complemented by a movable viewing stage that allows rapid and fine positioning of displayed film under the optics or for direct viewing. The stage can be moved as a unit + or - 12.7cm (5 inches) in the Y direction and + or - 14cm (5.5 inches) in the X direction.

[Z500] The stage glass has etched "L" marks to assist the operator in film placement. The marks can be used to position two non-overlapping windows of film which can then be scanned through the scope using only the stage movement controls. To use this feature, the arrow decals on the Zoom 500 scope must be aligned with the "L" decals.

1.2.2.1 Stage Positioning. The viewing stage moves over a stationary light source assembly housed beneath it. Film can be positioned and viewed through the stereoscope to within 1 inch of the front edge of the stage frame.

The operator is provided with two means of X and Y positioning of the stage:

a. "Hands on" positioning enables the operator to move the entire stage smoothly and rapidly anywhere within its range of travel by touch. This allows approximate positioning of the stage without using manual controls.

b. Mechanical drives, with front-mounted manual control knobs, enable 2.54cm (1.0-inch) per-revolution movement of the entire stage along the X and Y axes.

An adjustable drag mechanism changes the force required to move the overall stage. Drag can be varied according to operator preference or to restrain stage movement when operating on an uneven floor. A separate control is provided in each axis to lock the stage while viewing film. The locking force is 53 to 88 Newtons (12 to 20 pounds).

1.2.2.2 Stage Movement Controls. X and Y scanning is accomplished by individual stage movement controls for X and Y movement. The controls, located on the Y slide on the right front of the viewing stage, are close together to allow both to be operated simultaneously with one hand. The controls move with the stage in Y-motion, and are stationary in X-motion.

1.2.3 Light Sources. The HFO 4 is equipped with two types of light sources — high-intensity "spot" lights for film viewing with a scope and low-intensity "preview" lighting for direct viewing. All light sources are independently controlled and mounted in a single, nonpartitioned pan assembly to provide maximum operational and illumination area flexibility.

1.2.3.1 High-Intensity Light Sources. Each high-intensity quartz-halogen lamp assembly provides the light intensities required for viewing high resolution film at high magnification through the scope. In each lamp assembly, a lamp and dichroic-coated glass reflector provide a beam of light to a dichroic folding mirror that filters infrared light. A semicollimated beam of visible light is reflected upward through a color-correcting filter and the viewing stage to the scope's objective.

The lamp assemblies are mounted on rotatable arms that are magnetically linked to the stereoscope rhomboids to allow the light beams to track the movement of the rhomboids automatically. In addition, depending on the type of stereoscope for which a table is built, a third, stationary lamp assembly may be included for monoscopic viewing. The light beams are only under the objectives, thus eliminating the need for light masking apparatus to handle extraneous high-intensity light. This system requires scope modification. The modification is simple to accomplish (it does not require any machining or tapping) and consists of mounting magnet assemblies on the scope rhomboid arms.

[Z500 TABLES ONLY] Two light output levels are provided to automatically produce the best light output for the microscope objectives in use. The selection is made by a microswitch located in the vertical carriage. When focused for high-magnification (4X objectives), maximum light output is selected. For operator comfort and safety, a lower maximum is selected for all other objectives.

1.2.3.2 Preview Lighting. Standard fluorescent lamps provide low-intensity light for direct viewing of film. The area preview lights provide over 2,000 footlamberts intensity (nondimmable). A plastic diffuser provides more even distribution of light.

1.2.3.3 Light Source Controls. A single control panel, mounted on the right front of the table, houses an independent on/off/dimming control for each high-intensity light source and a separate HI/OFF/LO switch for each area preview cluster.

Each high-intensity lamp control consists of a rotary control which operates the lamp to "off" when turned fully counterclockwise and selects maximum brightness when rotated fully clockwise. Other lamp brightness levels are obtained by positioning the control between the extremes.

[Z240] When the center high intensity lamp control is operated to ON, power to the left and right lamps is cut off; when operated to OFF, power is available for operating the left and right lamps. This ensures that only the lamps required for either stereoscopic or monoscopic viewing are operational at any given time, thus preventing unnecessary or inadvertent operation of nonrequired lamps.

Each area lamp control selects the brightness of its associated area by operating all lamps for HI and only half the lamps for LO.

1.2.4 Vertical Carriage. The HFO 4 table's sturdy, vertically adjustable optics carriage accommodates the optics for which the table was designed. The carriage allows smooth, easy fine focus adjustment (0.69mm (0.027 inch) per revolution) of the scope at high magnification or coarse focus (2.74mm (0.108 inch) per revolution) with either the left or right hand. The concentric knob arrangement is free of backlash and has almost the same feel in up and down operation.

The vertical carriage and associated table framework are designed for operator accessibility to the optics. A gravity feed/mechanical clutch arrangement prevents damage to the optics or table by the downward feed of the scope upon contact with the stage. This feed mechanism allows the mount to be raised quickly by simply lifting.

The vertical carriage can be easily adjusted, with no disassembly, for collimation to the stage glass to within + or - 2 minutes of arc in both the X and Y axes. Parallelism of the viewing surface to its travel is also easily adjusted to within + or - 0.127mm (0.005 inch) over the entire surface.

[Z500 TABLES ONLY] HFO 4 table's are wired to accommodate electrical connection of the Zoom 500 stereoscope via a receptacle under the vertical carriage. This eliminates the need for the transformer normally supplied with the scope.

1.2.5 Optics Storage Box. A storage box, designed to hold a selection of commonly used objectives and eyepieces for the stereoscope, is located to the left of the vertical carriage mount.

1.2.6 Outlet Strip. An electrical outlet strip, located on the top frame to the right of the vertical carriage mount, is provided for connection of electrical devices. Power to the outlet strip is controlled by the table's main power switch and an integral 7 ampere on/off switch/circuit breaker.

1.2.7 Film Transport System. The HFO 4 Light Table is equipped with a motorized film transport system (optionally, a manual crank system) that will accommodate one or two strands of roll film simultaneously. Motorized or crank brackets (front and rear) and center idler brackets accept film spools conforming to MS26565 in widths up to 9.5-inches and lengths up to 1,000 feet.

The removable brackets attach rigidly to each end of the viewing stage to allow transport of film in both directions across the viewing surface. The viewing stage can be moved anywhere within its range of travel without disrupting film transport or positioning.

Segmented film rollers on each end of the stage permit simultaneous transport of two film strands in opposite directions or at different speeds. The film rollers are positioned to allow the film to be held slightly above the viewing surface.

When not in use (or for transport) each film bracket assembly can be stowed on the lower frame of the table. The mounting position allows the electrical connectors to remain attached and places the film rollers outboard to minimize incidental damage.

1.2.8 Mensuration System. The standard HFO 4 table is designed to permit the addition of a high-resolution mensuration system that measures X and Y movement of the viewing stage. The system is available either as a factory-installed option or as a later add-on to be field-installed by Richards. Most required mounting holes for the system are predrilled and tapped in the standard table. The system's electronics (control board, X-Y logic card, and display driver card) are rack-mounted in a chassis that mounts on the lower rear framework of the table for obstruction-free operation.

The mensuration system's resolution of 0.001 millimeter (0.00004 inch) is obtained through linear glass scale encoders mounted to the stage slide assembly in both the X and Y axes. The system will readout in either millimeters or inches.

1.2.9 Frequently Ordered Options. While most options change the catalog number of the table, an operator's chair, note surface, and CRT mount are available as non-catalog number add-ons.

1.2.9.1 Operator's Chair. A variety of optional chairs are available. Each is designed to compliment the table's work surface height and includes a gas-spring height adjustment feature.

1.2.9.2 Note Surface. An optional surface, designed to attach to pre-drilled and tapped holes in the table's arm rests, is available. The note surface provides a convenient writing surface for the operator's use. When not in use, it can be secured to the side of the table frame using its captive mounting screws.

1.2.9.3 CRT Mount. An optional CRT mount, designed to accommodate a variety of CRTs, is available. The mount positions the CRT at a convenient height and can be rotated to suit the particular operator.

1.2.10 Electrical Requirements. The light table operates from a single-phase a.c. electrical power supply of either 120-volt, 60-cycle or 220-volt, 50-cycle. (Refer to the nameplate for the rating of your unit.) The standard table is provided with a 4.6-meter (15-foot) length of rubber-covered, three-wire, grounding type power cord. One end is permanently attached to the light table and the other end terminates in a three-prong male plug compatible with the user's electrical service.

1.2.11 Finish. All exterior parts have a durable finish. Most aluminum parts are treated in accordance with MIL-A-8625. The frame and most other exposed metal surfaces have a textured paint finish.

1.2.12 Environmental Requirements. The table is designed to fit into a normal office environment at the rate of one table per 100 square feet and operated at maximum intensity without causing extraneous glare, noise, heat discomfort or distraction to other workers.

- Heat Output: Less than 1,000 BTU/hour
- Audible Sound Level: Under a 45 noise criterion curve (except during elevation)

1.2.13 Maintainability. The HFO 4 Light Table is designed to minimize downtime through simplicity of design and easy access to internal parts for replacement. Most of the table's electronics are accessible through a single, easily removed panel on top of the table. Control panels are readily removed for quick access to switches and controls.

All light sources are accessible by dropping the hinged pan assembly, requiring no disassembly to replace lamps. Lamps are low cost, readily available, and have a long life.

A safety interlock switch mounted in the electrical power box cuts power to all table circuits (including the outlet strip) when the light pan is opened.

1.2.14 Ergonomics. Human factors engineering is emphasized throughout the HFO 4 design. The table's height-adjustable work surface and comfortable, obstruction-free access to mounted optics all contribute to an operator's productivity by minimizing fatigue. All light table controls are arranged and positioned for easy access and operation from a seated position. Controls are arranged in clusters to allow:

- o Right-hand operation of all light sources
- o Right-hand operation of viewing stage motion (X and Y)
- o Right-hand table operation so the left hand is free to adjust and fine-focus the optical instrument
- o Right- or left-hand operation of the vertical carriage
- o Left-hand operation of the motorized film transport system

The HFO 4 Light Table is compact without restricting operator access, and sturdy but mobile. Cool and quiet operation, absence of extraneous high-intensity light, and low vibration to reduce eye fatigue, all contribute to operator comfort over long periods of operation.

1.3 SPECIFICATIONS. The specifications for the HFO 4 Light Table are listed in Table 1-1. In addition to the dimensional information contained in the table, a foot-print diagram is presented in Figure 1-2.

Table 1-1. Specifications

Manufacturer		The Richards Corporation
Model Designators covered by this manual:	HFO 4-522-54B00	HFO 4-232-54B0F
	HFO 4-522-54B0G	HFO 4-232-51B0H
	HFO 4-522-54B0H	HFO 4-522-50B00
	HFO 4-522-51B0H	HFO 4-522-54B0F
		HFO 4-232-54B0H
Dimensions:		

NOTE

The following specifications are for a unit with motorized film transport bracket assemblies mounted and the stage locking pins installed. For table footprint information, refer to Figure 1-2.

Length	137cm (54 inches)
Width	81cm (32 inches)
Height:	
Overall:	
Maximum	141cm (55.5 inches)
Minimum	128cm (50.5 inches)
Work surface:	
Maximum	97cm (38 inches)
Minimum	81cm (32 inches)

Table 1-1. Specifications - Continued

Weight:	
Net	313kg (690 pounds)
Shipping	432kg (950 pounds)
Power requirements:	
Voltage	120 a.c. (nominal) (220 a.c., optional)
Frequency	50/60 hertz
Current:	
120 VAC:	
Fuse value	15 amperes
Table draw (not including outlet strip)	6 amperes
Outlet strip (maximum)	7 amperes
220 VAC:	
Fuse value	10 amperes
Table draw (not including outlet strip)	3 amperes
Outlet strip (maximum)	7 amperes
Viewing stage:	
Dimensions:	
Length	127cm (50 inches)
Width	38cm (15 inches)
Travel:	
X-axis	27.9cm (11 inches)
Y-axis	25.4cm (10 inches)
Maximum light output:	
[Z500] Spotlights measured through Zoom 500 eyepiece at minimum zoom with 15X eyepieces:	
1X objectives	3,000 footlamberts (approx.)
4X objectives	2,000 footlamberts (approx.)
[Z240] Spotlights measured through Zoom 240 eyepiece at minimum zoom with 15X eyepiece:	
.43X objective	3,000 footlamberts (approx.)
Area preview lighting (measured at viewing stage):	
HI	2,500 footlamberts (approx.)
LO	1,400 footlamberts (approx.)
Film transport capacity:	
Length	Up to 1,000-foot rolls
Width:	
Single track	Up to 9.5 inches
Dual track	Total combined width up to 14.5 inches
Environmental requirements	Normal office setting